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Karl Fischer Titrator

USER MANUAL

01/2013, Edition 2A

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Section 1 Specifications

These are subject to change without notice!

Performance specifications		
Measuring principle		Volumetric titration according to Karl Fischer method for water content determination
Measuring range		Water content between 100 ppm or 0.01% and 100 % H ₂ O
Factor		0 to 99,999
Resolution 0–10 % H₂O		0.001 %
Resolution 10–100 % H₂O		0.01 %
Programs		4 KF titration programs and 1 calibration program
Languages		English, Spanish, French and Italian
Data logger		Last 50 data records
Memory	Date/time	DD-MM-YYYY
	Header text	2 lines of 40 characters each
	Users	Names of 4 users
	Comment text	8 lines of 40 characters each
	RS 232 C interface	Communication parameters for scales
Display		128 × 64 pt, backlit liquid crystal display
Keypad		7 membrane keys, splash-proof, PET, >6 million key-presses
Burette	Resolution	1/40,000 of nominal syringe value (at least 0.001 mL)
	Dosing accuracy	≤ 0.2 % (if volume >10 % of syringe volume)
	Reproducibility of dosing	±0.1 % (if volume >10 % of syringe volume)
	Material of syringe	Borosilicate glass and PTFE, 5 mL
	Material of electrovalve	Material with liquid contact: PTFE and KEL-F
	Material of tubes	Black tubes, PTFE
Reagent tubes		White tubes, PTFE
Peristaltic pump	Volumetric flow	170 mL/min ± 15 %
	Tube	Novoprene, internal diameter 3.2 mm
Inputs and outputs	Measuring electrode	BNC connector
	Magnetic stirrer	RCA connector (cinch)
	External keypad	Mini-DIN connector
	RS232 for computer or printer	Telephone connector (RJ9)
	RS232 for scales	Telephone connector (RJ9)
	Power supply, external	24 VAC, 1.25 A, 30 VA

Specifications

Dimensions of measuring instrument and environmental conditions	
Enclosure material	ABS and enameled steel
Mass	approximately 4 kg
Dimensions	130 × 160 × 300 mm
Working temperature	+15 to +40 °C (+60 to +104 °F)
Storage temperature	−10 to +50 °C (+14 to +122 °F)
Air humidity	<80 % relative humidity, non-condensing
Warranty	
Warranty	2 years

Section 2 General information

2.1 Safety information

Please read the entire user manual carefully before the equipment is unpacked, set up or put into operation. Pay attention to all danger and warning statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To make sure that the protection provided by this instrument is not impaired, do not use or install this instrument in any manner other than that specified in these operating instructions.

DANGER

Indicates a potentially or imminently hazardous situation that, if not avoided, results in death or serious injury.

WARNING

Indicates a potentially or imminently hazardous situation that, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation that may result in minor or moderate injury.

NOTICE

Indicates a situation that, if not avoided, could result in damage to the instrument. Information that requires special emphasis.

Note: Information that supplements points in the main text.

2.1.1 Warning labels

Read all labels and tags attached to the instrument. Personal injury or damage to the instrument could occur if not observed. For symbols applied to the instrument, corresponding warnings are provided in the user manual.

	This symbol, if noted on the instrument, references the instruction manual for operation and/or safety information.
	This symbol may be found on an enclosure or barrier within the product and indicates a risk of electrical shock and/or death by electrocution.
	Electrical equipment marked with this symbol may not be disposed of in European domestic or public disposal systems after August 12, 2005. In conformity with European local and national regulations, European electrical equipment users must now return old or end-of life equipment to the manufacturer for disposal at no charge to the user. Note: For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment, manufacturer-supplied electrical accessories, and all auxiliary items for correct disposal.

2.1.2 Chemical and biological safety

⚠ DANGER Potential danger in the event of contact with chemical/biological materials. Handling chemical samples, standards and reagents can be dangerous. Familiarize yourself with the necessary safety procedures and the correct handling of the chemicals before the work and read and follow all relevant safety data sheets.

Normal operation of this instrument may involve the use of hazardous chemicals or biologically harmful samples.

- Observe all cautionary information printed on the original solution containers and safety data sheet prior to their use.
- Dispose of all consumed solutions in accordance with national regulations and laws.
- Select the type of protective equipment suitable to the concentration and quantity of the dangerous material at the respective work place.

2.2 Overview of product

Volumetric titration according to the Karl Fischer (KF) method is an important method used to determine water content. The method is routinely applied in many fields, including the chemical, petrochemical, pharmaceutical and food industries. The method is also prescribed by a number of ASTM, ISO and DIN standards, as well as in regulations from European and US pharmacopeias (USP).

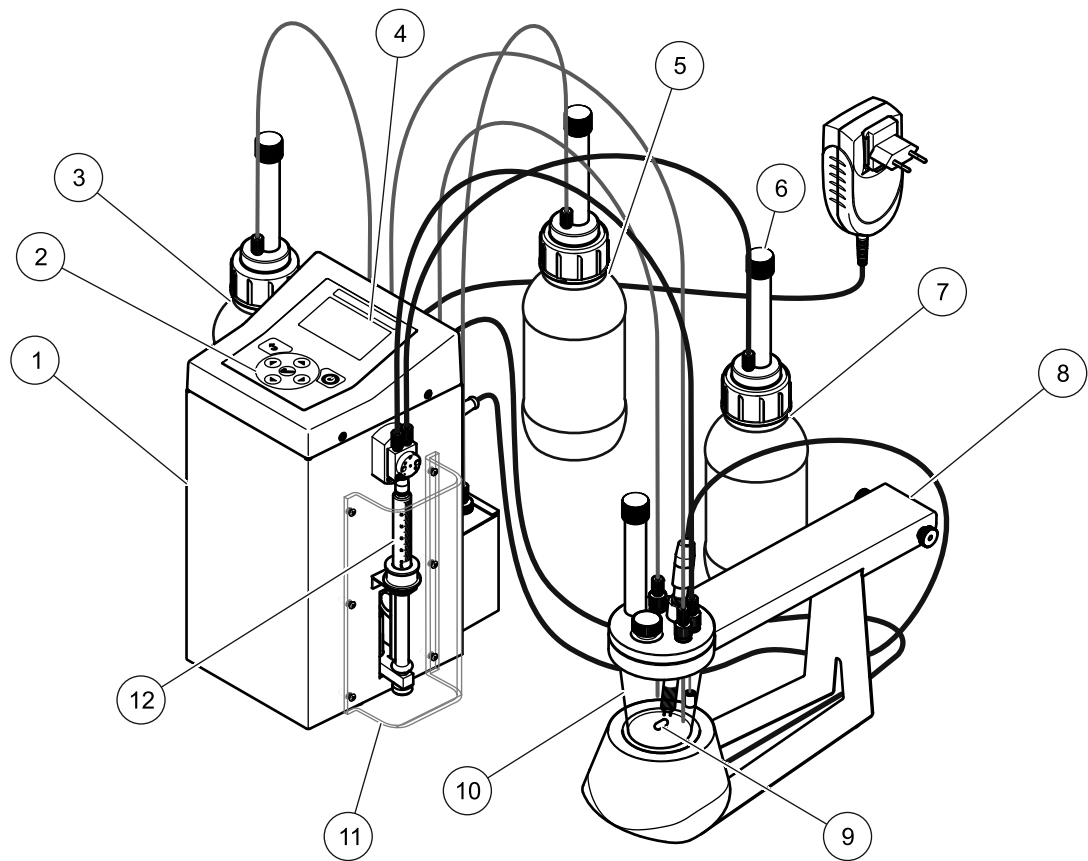
TitraLab is suitable for all KF solvents and reagents, whereby both one and two-component reagents can be used. The instrument covers a measuring range from 100 ppm to 100 % water.

Most applications are served by the four pre-programmed titration programs, though individual programs are also possible. The clearly structured user interface enables quick and simple navigation.

TitraLab features two RS 232 C interfaces to enable communication with a computer, printer or external scales (for automatic weight transfer). A PS/2 interface is also provided to allow the connection of a PC keyboard for entering alphanumeric sample names. A convenient titration stand is also integrated and equipped with stirrers and pumps to add and extract the KF reagents.

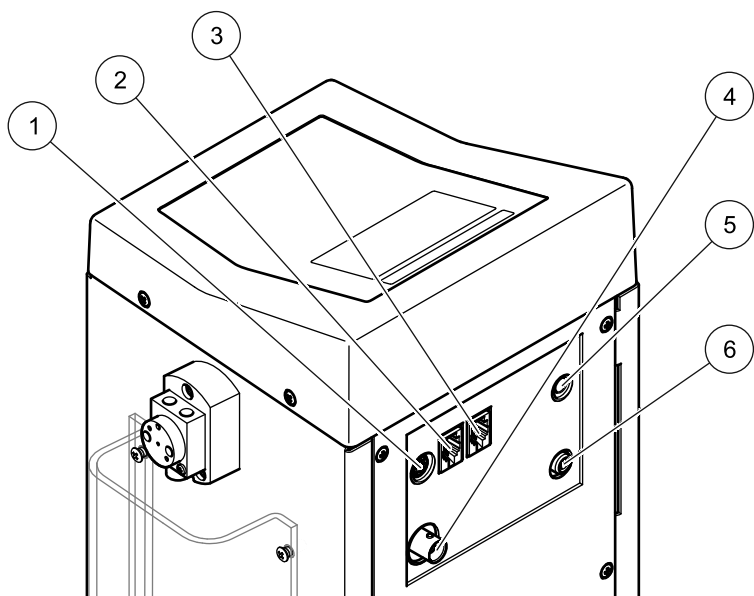
2.3 Front and back view

Figure 1 Front view



1	TitraLab Karl Fischer 1S2B	7	Titrant
2	Keypad	8	Titration stand
3	Waste container	9	Magnetic stirring bar
4	Display	10	Titration cell
5	Solvent	11	Syringe cover
6	Desiccant cartridges	12	Burette

Figure 2 Back view



1	PS/2 connector for keyboard	4	Electrode connector
2	RS 232 C for external scales	5	Connector for power supply
3	RS 232 C for printer or computer	6	Connector for magnetic stirrer

WARNING

Risk of injury to eyes, skin and respiratory

When working with chemicals and/or solvents, always observe the relevant accident prevention regulations and wear appropriate personal protective clothing for eye, face, hand, body and/or respiratory protection.

Make sure that the system is only unpacked, assembled, connected and operated by qualified and trained personnel.

3.1 Unpack the instrument

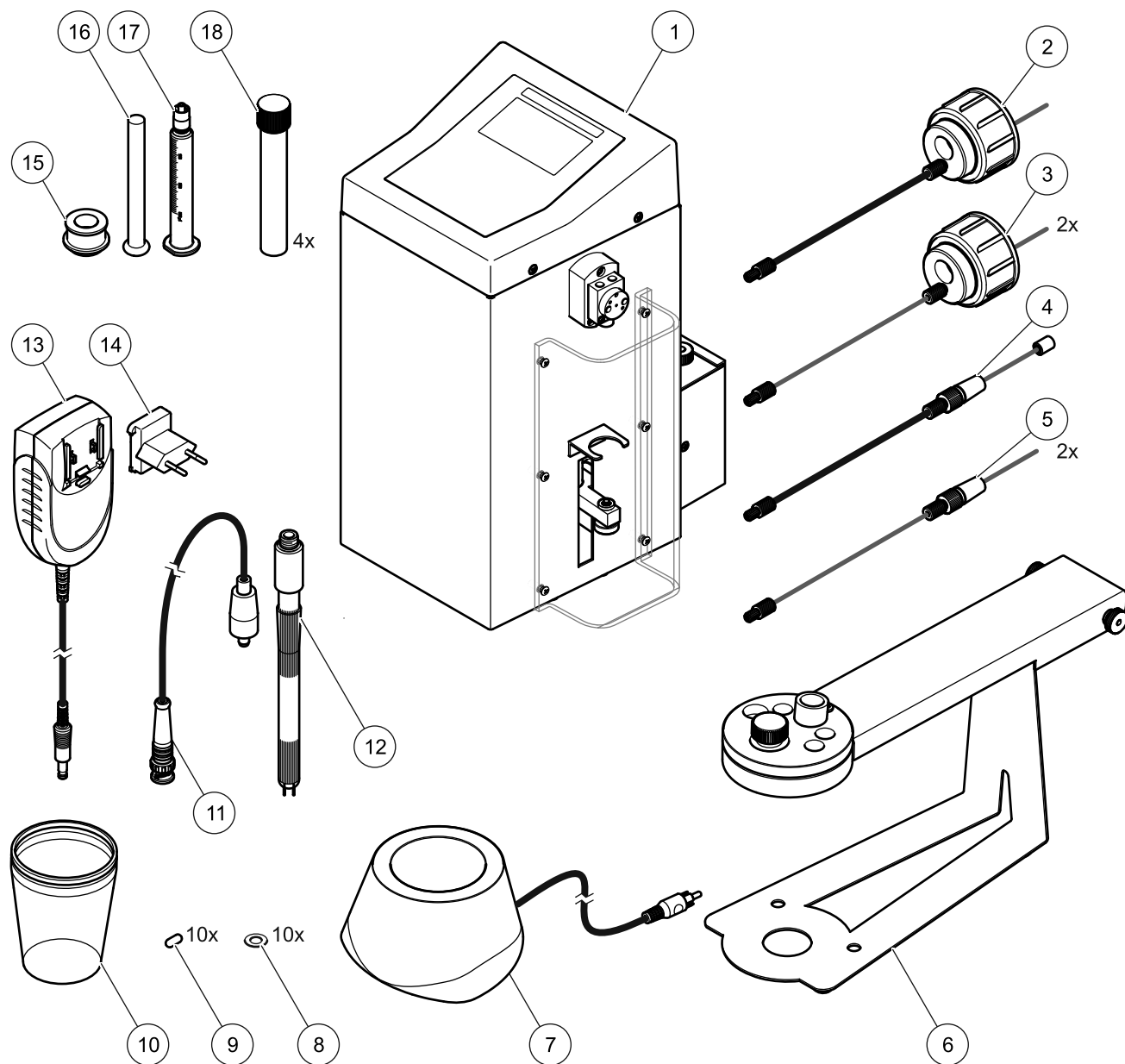
Unpack all supplied parts carefully, as they are highly sensitive in part to shock and impact. Read the user manual prior to installation and proceed exactly as described.

3.2 Scope of delivery

Please check that the order is complete. If anything is missing or damaged, please contact the manufacturer or retailer.

Installation

Figure 3 Scope of delivery



1 Titrator TitraLab Karl Fischer 1S2B	10 Titration cell
2 Burette titrant suction tube with bottle closure, DIN 45 thread, black	11 Electrode cable with BNC connector
3 2× Solvent or waste bottle tube with bottle closure, DIN 45 thread	12 Double-platinum electrode
4 Burette titrant addition tube with antidiffuser unit, black	13 Power supply, external
5 2×Solvent addition or suction tube with conical adapter	14 Adapter for power supply
6 Titration stand holder	15 Hardware sleeve
7 Magnetic stirrer	16 Syringe plunger
8 10×white O-rings for burette and pump threads	17 Syringe body
9 10× Teflon magnetic stirring bars (12 mm × 6 mm)	18 4×desiccant cartridge

3.3 Operating environment

Note the following points so that the instrument will operate correctly and have a long service life.

- Place the instrument firmly on an even surface. Do not push any objects under the instrument.
- The ambient temperature must be 15 to 40 °C (60 to 104 °F).
- The relative humidity should be less than 80 %; moisture should not condense on the instrument.
- A minimum clearance of 15 cm (5.9 in.) must be ensured above and on all sides of the device; this allows the air to circulate and prevents overheating of the electric parts. The dosage arm of the stepper motor operating the syringe piston must be able to move freely.
- Do not operate or store the instrument in extremely dusty, humid or wet locations.
- Make sure that no liquids enter the instrument and immediately wipe away any liquids that contact the instrument.
- Protect the instrument against vibrations, direct sunlight, corrosive gases as well as strong magnetic and/or electric fields.
- Only use genuine replacement parts and accessories.
- The instrument must be serviced by the manufacturer's service department at the prescribed intervals.

3.4 Installation

3.4.1 Installation of the burette

The burette dispenses the titrant, that is the one or two-component reagent.

The burette comprises the syringe, stepper motor and valve. The stepper motor and valve are already installed in the TitraLab; the syringe must be installed by the user.

WARNING

Risk of injury to pinch points and cuts

Make sure that the titrator is never used/operated without the syringe cover.

Make sure that the system is only assembled by qualified and trained personnel.

NOTICE

Warning against system damage

Make sure that the syringe is never operated without the attachment sleeve.

Only use genuine replacement parts and accessories.

The instrument must be serviced by the manufacturer's service department at the prescribed intervals.

Note: Make sure that you do not misplace the attachment sleeve for the syringe. It is not provided with a new syringe.

1. Push the syringe piston into the syringe body.
Slide the attachment sleeve fully onto the syringe so that the narrow end points toward the piston.
2. Remove the syringe cover by unscrewing it.

3. Point the syringe tip upward, place the syringe into the bracket such that the attachment sleeve is above the bracket.
4. With the narrow side facing down, carefully press the attachment sleeve into the bracket.
Hold the attachment sleeve in the bracket and screw the syringe onto the valve from below.
5. Withdraw the piston from the syringe and place it onto the screw in the dosage arm.
Hold the syringe piston and turn the attachment screw on the dosage arm into the thread in the piston.
6. Fix the syringe cover with six screws.

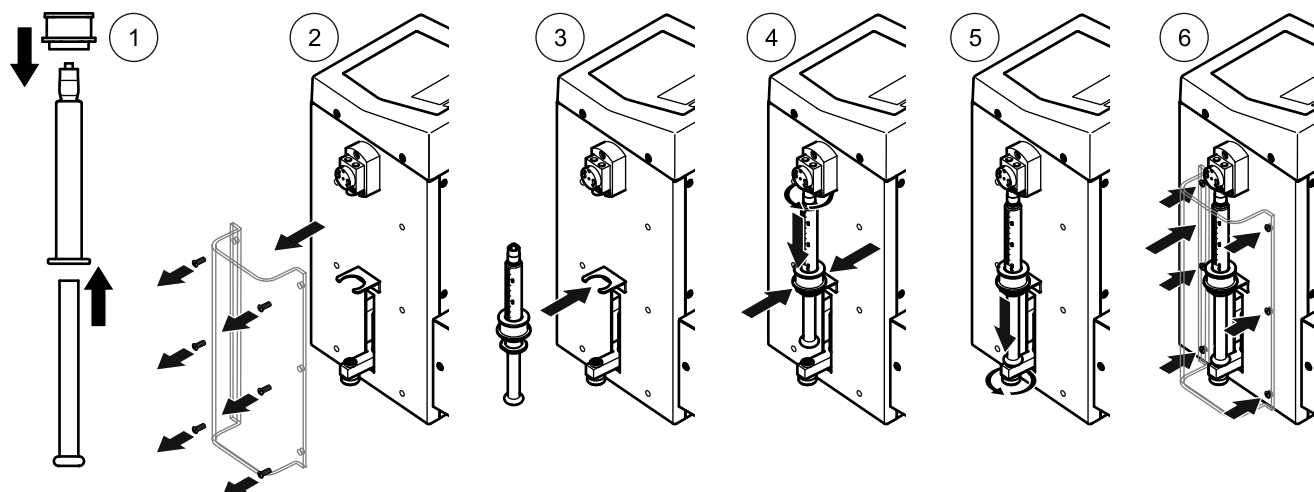
⚠ WARNING

Risk of injury to eyes, skin and respiratory

During the first days of system use, check the screw joint between the syringe and valve to avoid leaks and the potential escape of reagents.

When working with chemicals and/or solvents, always observe the relevant accident prevention regulations and wear appropriate personal protective clothing for eye, face, hand, body and/or respiratory protection.

Figure 4 **Installation of the burette**



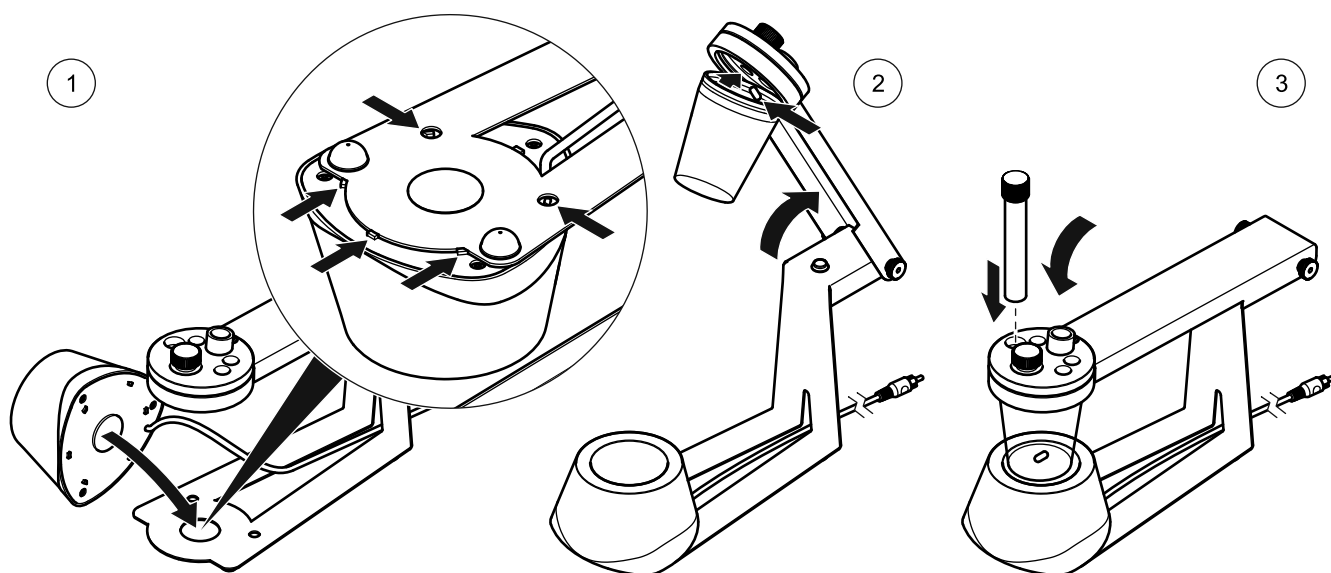
1	Push the piston into the syringe body. Slide the attachment sleeve onto the syringe.	4	Place the attachment sleeve into the bracket. Screw the syringe tip onto the valve.
2	Unscrew the six screws and remove the syringe cover.	5	Screw the piston onto the dosage arm.
3	Insert the syringe into the bracket.	6	Fix the syringe cover with six screws.

3.4.2 Installation of the titration stand

The titration stand consists of a holder onto which the titration cell and magnetic stirrer are attached. The actual KF titration is performed in the titration cell. Since air humidity disturbs the titration process, the titration cell is hermetically sealed by means of an airtight lid.

1. Place the magnetic stirrer onto the base of the titration stand so that it locks into place.
2. Place a magnetic stirring bar into the titration cell glass.
Press the titration cell glass into the lid from below so that it locks into place.
3. Lower the titration cell onto the magnetic stirrer.
Place a desiccant cartridge into the designated opening in the titration cell lid.

Figure 5 Installation of the titration stand

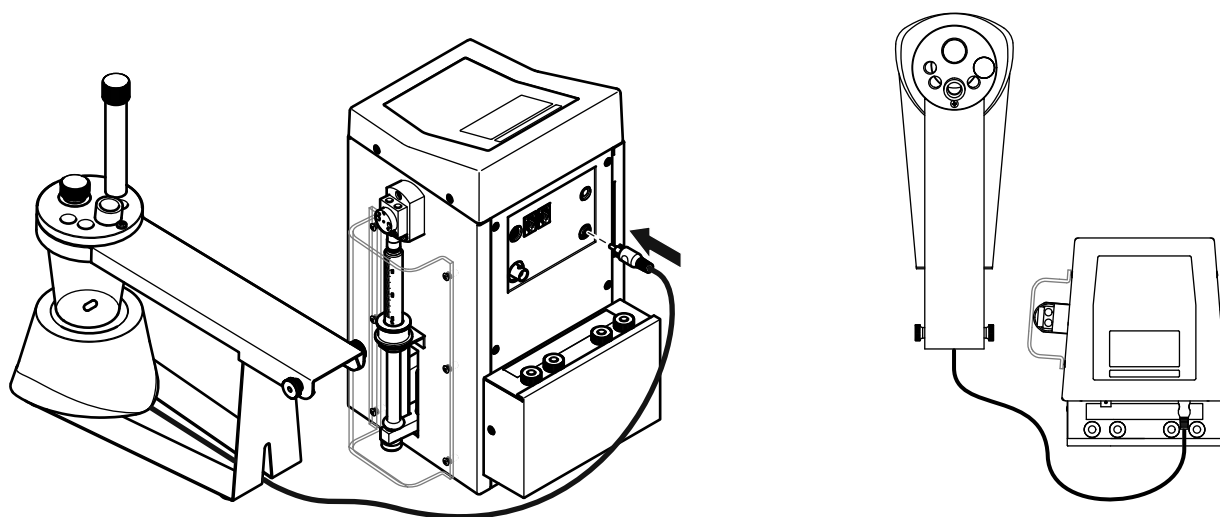


1 Lock the magnetic stirrer into place on the titration stand base.	3 Lower the titration cell onto the magnetic stirrer. Place a desiccant cartridge into the titration cell lid.
2 Place a magnetic stirring rod in the titration cell glass. Attach the titration cell glass to the lid.	

3.4.2.1 Electrical connection of the magnetic stirrer

1. Connect the cable of the magnetic stirrer to the **STIRRER** port on the back of the TitrLab.
The power is supplied via the TitrLab.

Figure 6 Electrical connection of the magnetic stirrer



1 Connect the cable of the magnetic stirrer to the STIRRER port.
--

3.4.3 Installation of tubes

⚠ WARNING

Risk of injury to eyes, skin and respiratory

During the first days of system use, check the screw joint between the syringe and valve to avoid leaks and the potential escape of reagents.

When working with chemicals and/or solvents, always observe the relevant accident prevention regulations and wear appropriate personal protective clothing for eye, face, hand, body and/or respiratory protection.

Make sure that the tubes are never kinked.

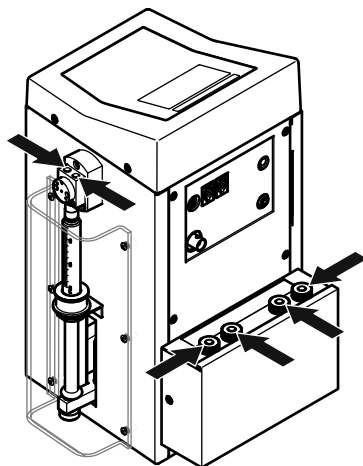
Regularly check the system as well as all tubes and connections for leaks, condition and cleanliness.

To prevent twisting of the tubes, you should always connect flange tube connections before those with grommets.

3.4.3.1 Removal of protective stickers

1. Remove the protective stickers on the burette valve and the four pump connections.
2. Make sure that the pre-installed white O-rings are not removed.
3. Check that the O-rings are in a horizontal position inside the thread.

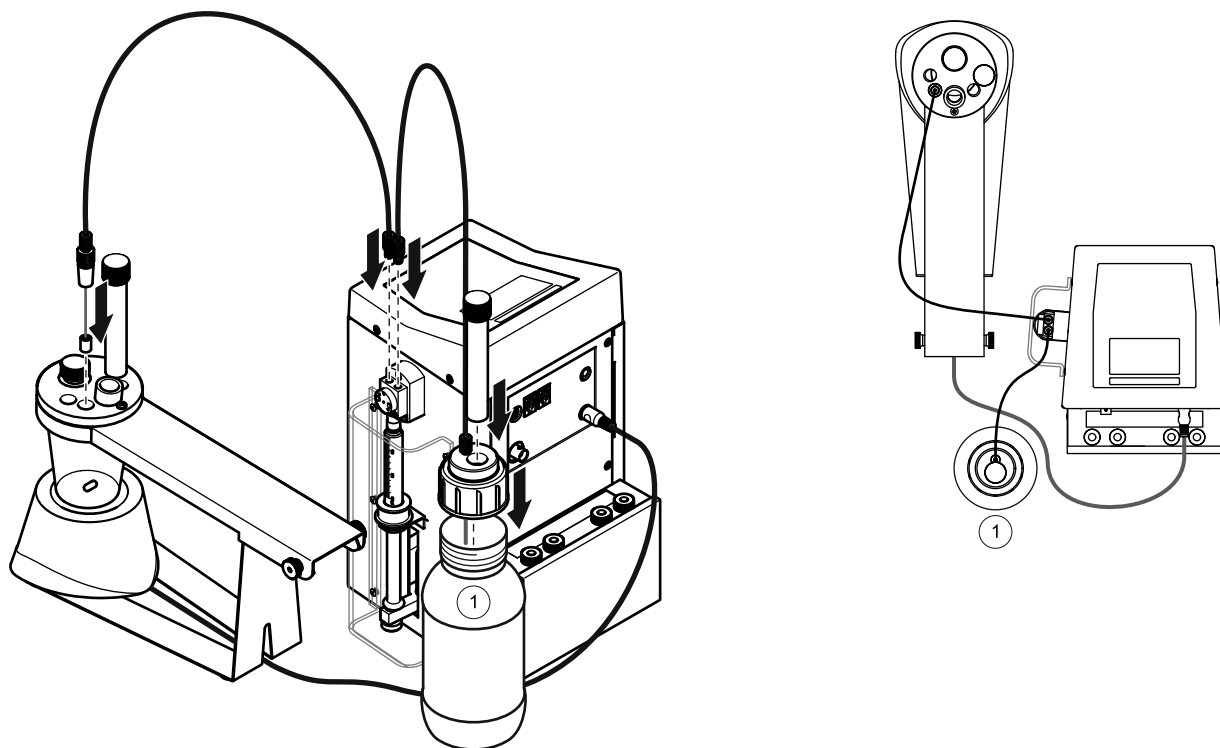
Figure 7 Position of protective stickers



3.4.3.2 Connection of tubes for KF titrant

1. Screw the black burette feed tube onto the valve.
2. Screw the bottle closure of the feed tube onto the titrant bottle for the KF reagent (bottle 1 [Figure 8](#)).
3. Place the desiccant cartridge into the designated opening in the bottle closure.
4. Screw the black burette discharge tube onto the valve.
5. Insert the conical adapter with the antidiffuser unit of the discharge tube into the designated opening in the lid of the titration cell.

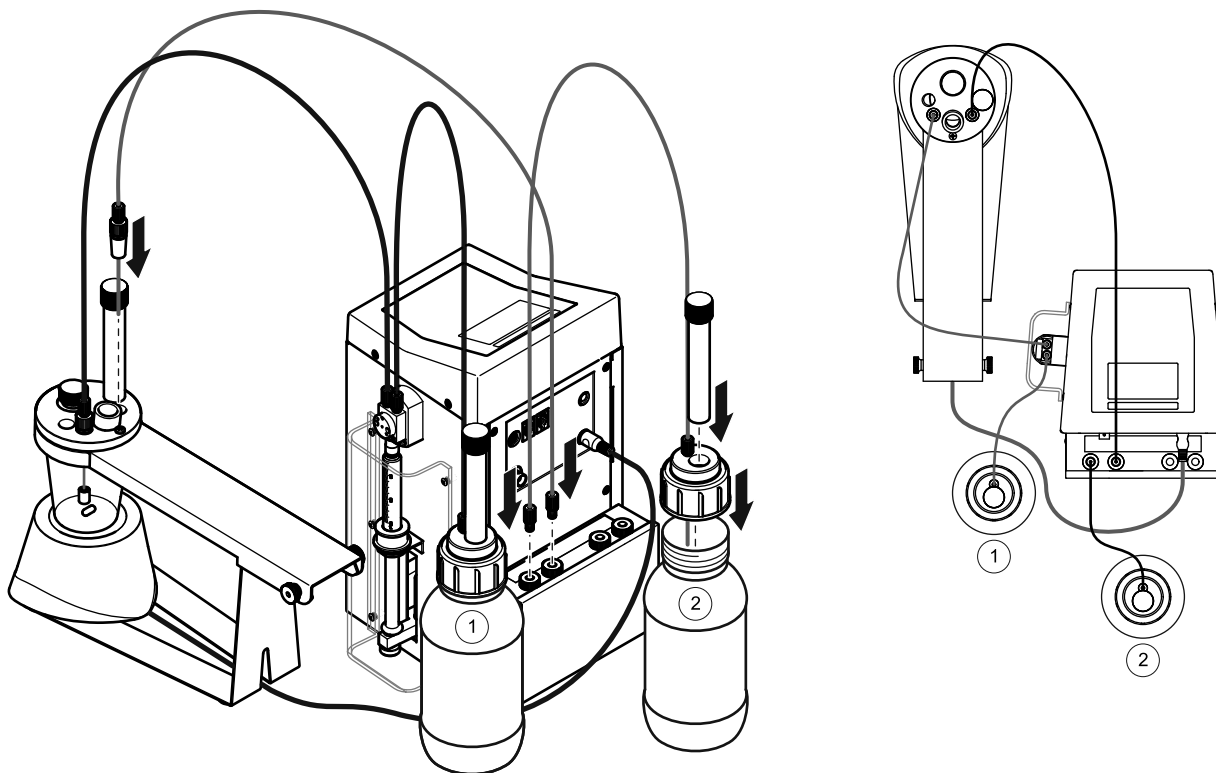
Figure 8 Connection of tubes for KF titrant



3.4.3.3 Connection of tubes for solvent

1. Pick up a white tube with bottle closure.
2. Screw the tube into the IN socket on pump 1.
3. Screw the bottle closure onto the solvent bottle (bottle 2 [Figure 9](#)).
4. Place the desiccant cartridge into the designated opening in the bottle closure.
5. Pick up a white tube with conical adapter.
6. Screw the tube into the OUT socket on pump 1.
7. Insert the conical adapter into the designated opening in the lid of the titration cell.
8. The tube extends approximately 3 cm (1.2 in.) into the titration cell.

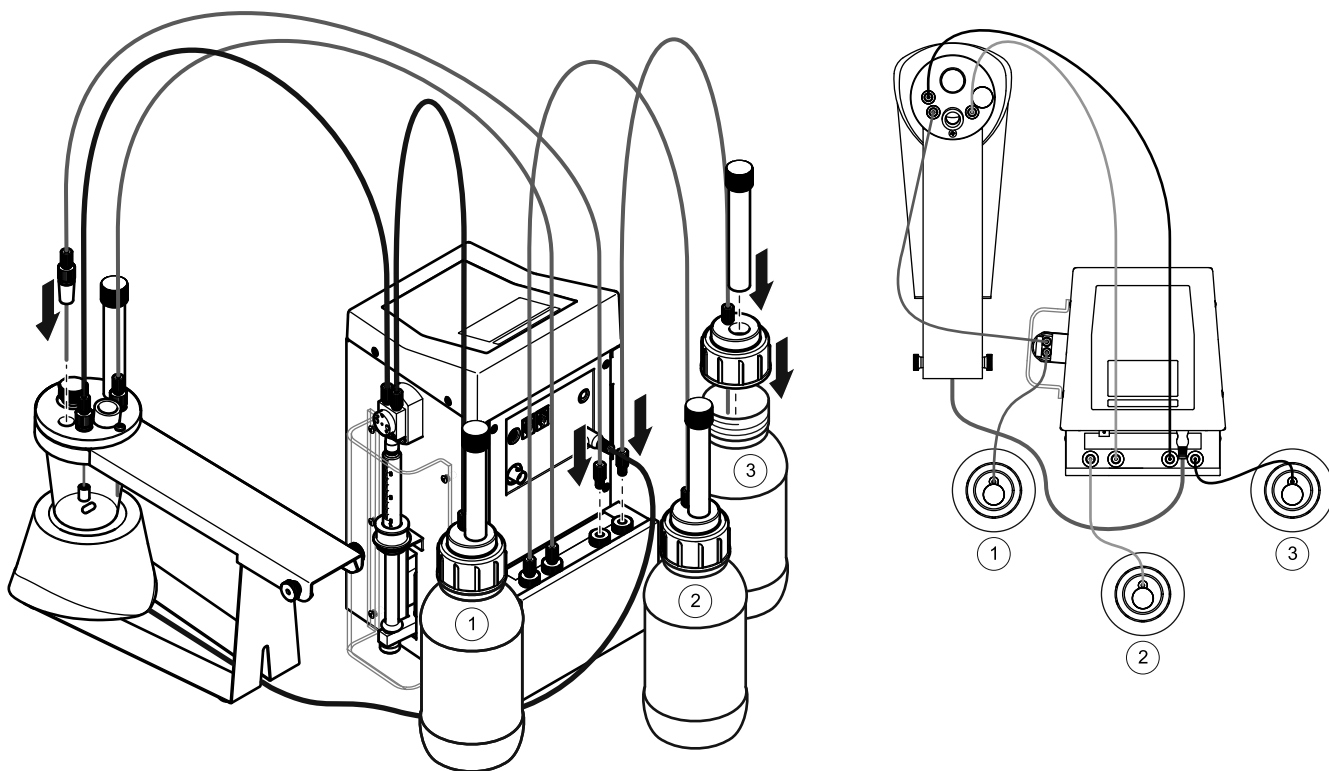
Figure 9 Connection of tubes for solvent



3.4.3.4 Connection of tubes for waste bottle

1. Pick up a white tube with conical adapter.
2. Screw the tube into the IN socket on pump 2.
3. Insert the conical adapter into the designated opening in the lid of the titration cell.
4. The tube extends to the bottom of the titration cell.
Note: Make sure that the tube end doesn't hit the magnetic bar while stirring.
5. Pick up a white tube with bottle closure.
6. Screw the tube into the OUT socket on pump 2.
7. Screw the bottle closure onto the waste bottle (bottle 3 [Figure 10](#)).
8. Place the desiccant cartridge into the designated opening in the bottle closure.

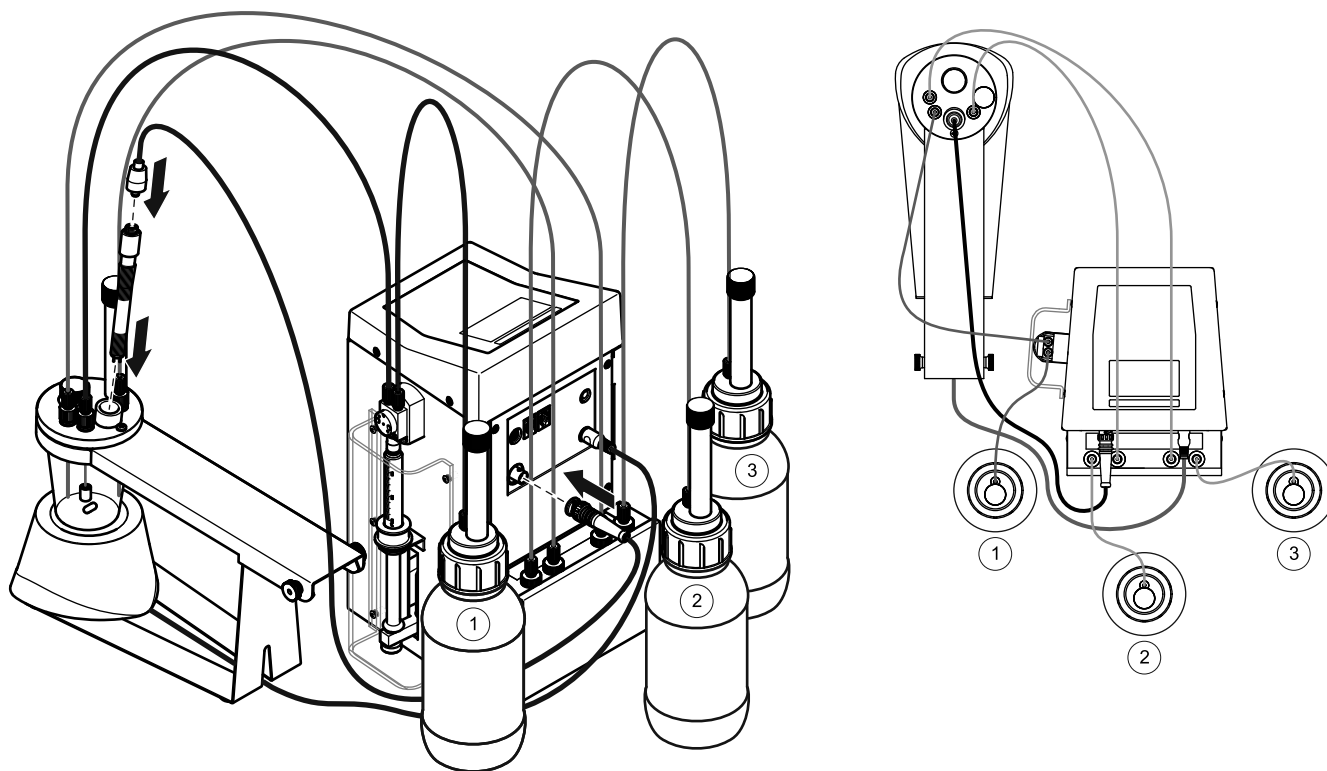
Figure 10 Connection of tubes for waste bottle



3.4.4 Electrode

1. Remove the red cap from the electrode connector.
2. Screw the electrode cable onto the electrode.
3. Remove the white cap from the tip of the electrode.
4. Place the electrode into the designated opening on the lid of the titration cell.
5. Connect the electrode cable to the **ELECTRODE** port on the back of the TitraLab.

Figure 11 Connection of the electrode



3.4.5 Power supply, external

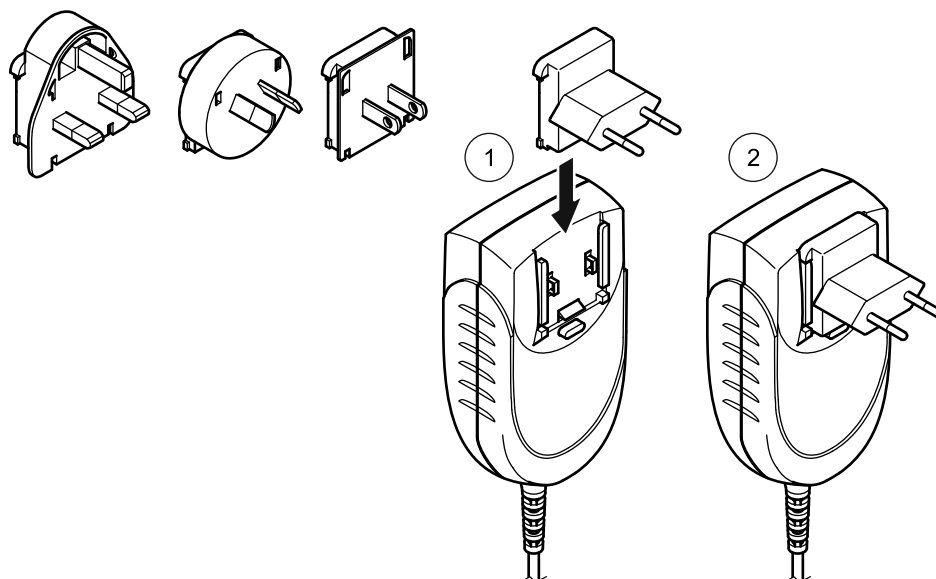
⚠ DANGER

Risk of electric shock

Make sure the AC supply voltage is suitable for the power supply and the mains plug style is suitable for the type of outlet socket.

Only use the original power supply and plug connectors.

The power supply is provided with different plug connectors. The correct plug connector must be attached to the power supply before first use.

Figure 12 Plug connector attachment

1 Slide the plug connector into the power supply.

2 Click the plug connector into place.

***Note:** To change the plug connector, press in the catch and slide the plug connector upward.*

3.5 Keypad

ON/OFF key

Navigation key UP

- Used to select between different options on the display.
- Increases numeric values.
- Shows the previous data record in the data log menu.
- Empties the syringe through the discharge tube during manual open loop control.

Navigation key DOWN

- Used to select between different options on the display.
- Reduces numeric values.
- Shows the next data record in the data log menu.
- Fills the syringe through the feed tube during manual open loop control.

Navigation key LEFT

- Moves the cursor backward for entry of numeric values.
- Scrolls up in menus.
- Empties the syringe through the feed tube during manual open loop control.

Navigation key RIGHT

- Moves the cursor forward for entry of numeric values.
- Scrolls down in menus.

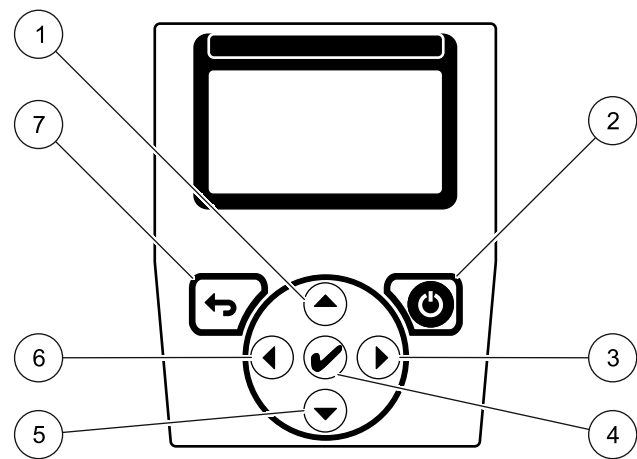
RETURN key

- Scrolls back in menus.
- Cancels a manual control.
- Cancels a titration.
- Shows the most recent calibration data in calibration mode.

OK key (Check mark)

- Confirms the gray-highlighted menu items and scrolls forward in the menu.
- Shows the first data record in the data log.

Figure 13 Keypad

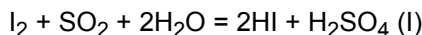


1	Navigation key UP	5	Navigation key DOWN
2	ON/OFF key	6	Navigation key LEFT
3	Navigation key RIGHT	7	RETURN key
4	OK key (Check mark)		

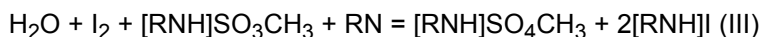
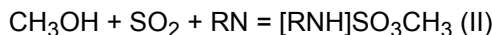
3.6 Reagents

3.6.1 Chemical reactions

Karl Fischer titration is based on the principle of oxidation of sulfur dioxide by iodine in the presence of water. It is the same principle as for the iodometric titration of sulfur dioxide in water.



However, a shift in equilibrium in the above reaction (I) to the right requires the neutralization of the formed hydriodic or sulfuric acid. In many cases, imidazole is used as a buffer for this purpose. The solvent methanol is also involved in the reaction. The Karl Fischer reaction can be described by the following reactions:



(RN denotes the employed base)

3.6.2 Titrant and solvents

TitraLab is suitable for all KF solvents and reagents, whereby both one-component and two-component reagents can be used.

3.6.2.1 One-component reagents

The titrant contains all required chemical compounds, such as iodine, sulfur and the base, as a single reagent.

The common titer value is 5 mg of water per mL of titrant.

Any solvent can be used to dissolve the sample, provided it has a methanol content of at least 25 %.

One-component reagents have the following advantages:

- Unlimited water capacity.
- Allows specific solvent matrix composition to test difficult to dissolve samples.

3.6.2.2 Two-component reagents

The titrant contains iodine dissolved in methanol.

Titer values of 1, 2 and 5 mg of water per mL of titrant are commonly used.

The titrant of the titer should be chosen on the basis of the expected water concentration so that the titration can be performed with a single burette filling.

The solvent contains sulfur dioxide, a base and methanol.

Two-component reagents have the following advantages:

- Rapid titration due to high reaction kinetics.
- Improved reproducibility due to stable reaction environment with constant pH value and unchanging sulfur dioxide concentration.
- Higher buffer capacity.
- Higher titrant titer stability.

Section 4 Operation

4.1 Switch on the instrument

Become familiar with the instrument functions before operation. Learn how to navigate through the menu and perform the relevant functions.

1. Connect the input connector of the power supply to the **POWER IN** port on the back of the TitraLab.
2. Connect the power supply to a power socket.
3. Press **ON/OFF** below the display to switch on the instrument.
4. The instrument performs a self-test upon each activation.

***Note:** Wait approximately 20 seconds before switching on again so as not to damage the electronics and mechanics of the instrument*

4.2 Startup

4.2.1 Language and data output setting

The titrator software supports multiple languages. The first time the instrument is switched on, a language selection list is displayed automatically upon completion of the self-test.

1. Select the required language.
2. Press **OK** to confirm the selection.
3. Select the type of data output (deactivated, printer, computer) and confirm with **OK**.

4.2.1.1 Change the language setting

The instrument functions in the selected language until the option is changed.

1. Turn the instrument on.
2. Select **SYSTEM > LANGUAGE**.
3. Select the required language.
4. Press **OK** to confirm the selection.

4.2.1.2 Change the data output setting

The instrument functions in the selected data output until the option is changed.

1. Turn the instrument on.
2. Select **SYSTEM > DATA OUTPUT**.
3. Select the required setting.
4. Press **OK** to confirm the setting.

4.2.2 First steps after installation

1. Prime the burette with titrant ([section 4.7.1](#)).
2. Prime the pump solvent to add the reagent ([section 4.7.2](#)).
3. Check the stirring speed ([section 4.7.3](#)).
4. Prime the pump waste to dispose the reagent ([section 4.7.2](#)).

4.3 Menu structure

***Note:** [Section 6 Troubleshooting](#) provides a list of all error and warning messages, and also describes all necessary countermeasures.*

Operation

MAIN MENU	
TITRATE	Titration program to determine water content; refer to section 4.6, page 31 .
P1 KF Standard	Default setting of activated titration program.
Select Prg	Changes the default setting.
P1. KF Standard	KF Standard with automatic drift control, unit %.
P2. KF < 1% H2O	Titration program for very low water content.
P3. KF > 10% H2O	Titration program for high water content.
P4. KF Standard	KF Standard, unit mg/mL.
Statistics	Statistical calculation of results.
No	No.
Yes	Yes.
No of results	Number of analyses.
Continue..	Preparation of titration cell.
Disp. Solvent	Dispenses new solvent into the titration cell.
Continue..	Starts the pre-titration.
Continue..	Pre-titration completed successfully; the titration cell has been conditioned.
Start Titration	Dispense the sample into the titration cell and start the titration.
Weight Entrance	Enter the weight of the sample.
Result	Displays the result.
STANDARDIZATION	Calibration program for exact titer determination of titrant; refer to section 4.5, page 30 .
Statistic	Statistical calculation of results.
No	No.
Yes	Yes.
H2O (mg/mL)	Entry of water content of standard.
Continue..	Preparation of titration cell.
Disp. Solvent	Dispenses new solvent into the titration cell.
Continue..	Starts the pre-titration.
Standard Dispensation	Dispense the standard into the titration cell and start the titration.
Result	Displays the result.
Accept Result	Saves the factor for all titration programs.
Repeat Sample	Starts another calibration.
MANUAL ACTIVATION	Select which element is to be controlled manually; refer to section 4.9, page 35 .
Burette	Manual control of burette.
Return	Empties the burette into the titrant bottle (navigation key LEFT)
Empty	Empties the burette into the titration cell (navigation key UP)
Fill	Fills the burette with titrant (navigation key DOWN)
Pumps	Manual pump open loop control.
Empty Vessel	Activates pump 2, empties the titration cell into the waste bottle.
Dispense Solvent	Activates pump 1, dispenses solvent into the titration cell.
Start Actuation	Exit the menu.
Stirrer	Sets the stirring speed. Select ON/OFF with OK. Select the stirring speed with UP/DOWN.

MAIN MENU	
PROGRAMMING	Individual adjustment of saved programs; refer to section 4.8, page 33 .
P1: KF Standard	KF Standard with automatic drift control, unit %.
Program	Program status.
Activated	Active.
Deactivated	Inactive.
Type	Type of titration.
Classic	For titration with standard reagents.
Special	For titration with special reagents.
Extraction	Type of water extraction.
Previous to titrat	Time between dispensing of sample and start of titration.
During Titration	Minimum duration of titration.
No	Start of titration, directly after addition of sample.
Std. V.	Standard volume in mL.
EP Delay	End point delay; time during which the end point of the reaction must remain stable.
Max. Vol.	Maximum volumes of the titration cell.
Drift C.	Drift control.
Automatic	Automatic; maximum drift limit 30 µL/min.
Manual	Manual; sample can be added at any time.
Units	Unit of the result: mL, mg, ppm, %, A.U. volume, A.U. weight.
L. Comment	Comment lines.
No	No.
Yes	Yes, up to 8 lines.
P2: KF < 1%	Titration program for very low water content.
P3: KF > 10%	Titration program for high water content.
P4: KF Standard	KF Standard, unit mg/mL.
KF Standardization	Calibration program.
Type	Type of titration.
Classic	For titration with standard reagents.
Special	For titration with special reagents.
Standard	Type of standard solution.
Standard (G)	Standard solution, water concentration in g.
Standard (V)	Standard solution, water concentration in mL.
H2O	Distilled water is standard solution.
Tartrate	Sodium tartrate 2-hydrate.
Std. V.	Standard volume in mL.
EP Delay	End point delay; time during which the end point of the reaction must remain stable.
Drift L.	Maximum drift limit.
Max. Vol.	Maximum volumes of the titration cell.
L. Comment	Comment lines.
No	No.
Yes	Yes, up to 8 lines.

Operation

MAIN MENU	
DISPLAY DATA	Data log with up to 55 results; refer to section 4.9, page 35 .
Empty Data-Logger	Empties the data log.
Display Data	Display results with search filters.
By Date	Display results by date.
By Sample ID	Display results by sample ID.
By User	Display results by user.
By Type	Display results by titration or calibration.
Continue..	Display all results.
SYSTEM	System settings; refer to section 4.11, page 35 .
Reagent's Name	Reagent name; entry of no more than 10 characters.
Operator's Name	Up to four operator names can be defined.
Operator 1	Operator name; entry of no more than 17 characters.
Data Output	Define the data output; refer to section 4.10, page 35 .
Deactivated	Deactivates the data output.
For Printer	Activates data output on the printer.
For Computer	Activates data output on the computer.
Volume Test	Program for burette calibration and control.
Temperature	Entry of temperature.
Pressure	Entry of air pressure.
Weights E	Entry of weight.
Manual	Manual weight entry.
Automatic	Automatic weight entry via scales connection.
Operator	Operator name; entry of no more than 17 characters.
Start Test	Starts the volume test.
Entry of weights	Type of weight entry.
Weights E	Entry of weight.
Manual	Manual weight entry.
Automatic	Automatic weight entry via scales connection.
Baud Rate	Entry of baud rate: 1200, 2400, 4800, 9600, 19200.
Word Length	Entry of word length: 8 or 7.
Parity	Selection of parity: none, even, odd.
Stop Bits	Number of stop bits: 1 or 2.
Continue...	Return to system menu.
Standby Cycle	Entry of standby interval.
Time D. Solvent	Time during which the solvent is dispensed into the titration cell.
Date/Hour	Entry of date and time.
Display Contrast	Selection of display contrast.
Language	Selection of operating language
SPANISH	
ENGLISH	
ITALIAN	
FRENCH	

4.4 General information on KF titration

4.4.1 Individual titration steps

Regardless of whether a one or two-component reagent is used, the titration process involves the following steps.

1. Fill the burette with titrant.
2. Fill the titration cell with solvent.
3. Pre-titration

Water traces added via the solvent are removed. The titration cell is conditioned.

4. Dispense the sample into the titration cell.
5. Titrate the water content of the sample.
6. Enter the sample amount.
7. Calculation of result.

The titrator calculates the water content of the sample with consideration of the measured drift, factor and blank value.

8. Replace the solvent.

Multiple titrations can be performed with the same filling of the titration cell. However, a minimum methanol content of 25 % and pH value between 5 and 7 is essential.

4.4.2 Titration cell

Karl Fischer titration is more complex than most other volumetric titration methods. Note the following points in particular:

- Water is everywhere, even in the air, and unwanted water ingress will distort the results. The pump-controlled filling and emptying of the titration cell allows solutions to be replaced and dispensed without the need to open the titration cell. The titration cell only needs to be opened briefly in order to dispense the sample. The desiccant in the cartridges must also be replaced at regular intervals.

4.4.3 Stirring speed

Select a stirring speed that ensures maximum mixing of the solutions without adding excessive amounts of air. If the stirring speed is too slow, this can distort the results; overly fast stirring, on the other hand, can disrupt the actuation of the electrodes.

Set the required stirring speed during pre-titration; do not change it again during an analysis.

1. Adjust the stirring speed by pressing the Navigation keys UP/DOWN during the pre-titration.

4.4.4 Removal of bubbles

Before titration or calibration is started, the titrator empties the contents of the burette into the titrant bottle. The burette is then filled, which removes any bubbles from the syringe and tube.

4.4.5 Standby cycle

If the titrator remains in drift control for more than 15 minutes, the standby cycle is activated automatically.

- The contents of the burette are pumped back into the titrant bottle.
- The magnetic stirrer is switched off.

To exit the standby cycle, select **START TITRATION**.

- The burette is filled.
- The pre-titration is started and the titration cell is conditioned.
- Drift control: checks whether the calculated drift values match the programmed thresholds.
- Sample can be dispensed.

4.4.6 Standard water solutions

STANDARD (V): a standard solution with a known water quantity per mL of standard. The default setting is 5.00 mg H₂O/mL; this value can be changed, but should be between 1 and 5 mL of standard.

STANDARD (G): a standard solution with a known quantity of water per g of standard. The default setting is 10.00 mg H₂O/g; this value can be changed but should be between 0.5 and 2 g of standard.

H₂O: distilled water. The recommended quantity to be used is 10 to 25 mg of water.

TARTRATE: sodium tartrate 2-hydrate. A primary standard with a water content of 15.66 %. The recommended quantity to be used is 0.1 to 0.15 g of standard.

Recommended titrant consumption volumes are between 20 and 100 % of the burette volume.

4.4.7 Empty the titration cell

***Note:** The discharge tube must reach to the bottom of the titration cell during emptying. The tube must then be pulled back up to allow the magnetic stirring bar to move freely.*

If a sample fails to dissolve in the titration cell, it is better to remove and empty the titration cell manually to prevent pump blockage.

The tubes should not touch the liquid in the titration cell during a titration or calibration process.

The titration cell should be emptied at the end of the working day; refer to [section 5.2, page 37](#).

4.5 Calibration

Before a sample can be analyzed, a calibration is performed to determine the exact titer of the titrant. This requires a standard solution with a known water content.

1. Select **STANDARDIZATION** and press **OK** to confirm.
2. Select **STATISTICS > NO** or **YES** to perform a statistical analysis.

If **YES** is selected, enter the number of analyses used to determine the factor. The absolute and relative standard deviation is shown.

3. Enter the water content of the employed standard solution in mg/mL.
4. Select **CONTINUE..** and press **OK** to confirm.

5. Select **DISPENSE SOLVENT** and press **OK** to dispense the solvent into the titration cell.
6. Select **CONTINUE..** and press **OK** to confirm.

The pre-titration starts automatically. The water content of the solvent and the drift are determined. **WAIT** is shown in the display.

Adjust the stirring speed by pressing the Navigation keys UP/DOWN If required.

Once the pre-titration has been completed and the titration cell conditioned, the text **CONTINUE..** is shown in the display.
7. Press **OK** to confirm.
8. Dispense the standard solution into the titration cell and press **OK** to confirm.
9. The titration begins; the titrator continuously determines the optimum rate of titration addition. Once the titration has been completed, the drift control is activated.

The result is shown in the display and sent to the printer or computer if applicable.
10. Press **OK** to confirm the result.
11. To save the factor for all titration programs (including inactive programs), select **ACCEPT RESULT** and press **OK** to confirm.
12. A new calibration can be started with **REPEAT SAMPLE**.
13. Following successful calibration, the titration cell is ready for sample analysis.

4.6 Titration

1. Select **TITRATE** and press **OK** to confirm.
2. Select the titration program if more than one program is activated.
3. Select **STATISTICS > NO** or **YES** to perform a statistical analysis.

If **YES** is selected, enter the number of analyses. The absolute and relative standard deviation is shown.
4. Select **CONTINUE..** and press **OK** to confirm.
5. If you require a new solvent filling, select **DISPENSE SOLVENT** and confirm with **OK**.

The solvent is dispensed into the titration cell.
6. Select **CONTINUE..** and press **OK** to confirm.

The pre-titration starts automatically. The water content of the solvent and the drift are determined. **WAIT** is shown in the display.

Once the pre-titration has been completed and the titration cell conditioned, the text **CONTINUE..** is shown in the display.
7. Press **OK** to confirm.
8. Dispense the sample into the titration cell.

Use a pipette to dispense liquid samples. Viscous samples are dispensed with a syringe and solid samples with a weighing boat/funnel.

Open the filler inlet in the titration cell lid and add the sample. The filler inlet must then be closed immediately to avoid the ingress of air humidity, which would distort the results.

9. Select **START TITRATION** and press **OK** to confirm.

The titration begins in accordance with the selected program. The titrator continuously determines the optimum rate of titrant addition.

After the titration, **WEIGHT ENTRANCE** is shown in the display.

Note: Need for entering weight depends on the result unit selected.

10. Enter the weight of the sample via the keypad and press **OK** to confirm the entry.

Drift control is activated automatically; the result is shown in the display and sent to the printer or computer if applicable.

11. Press **OK** to confirm the result.

Further samples without emptying of titration cell

Multiple samples can be analyzed with the same titration cell filling.

1. To do so select **CONTINUE..** and press **OK** to confirm.

2. Dispense the new sample into the titration cell.

3. Select **START TITRATION** and press **OK** to confirm.

After the titration, **WEIGHT ENTRANCE** is shown in the display.

Note: Need for entering weight depends on the result unit selected.

4. Enter the weight of the new sample via the keypad and press **OK** to confirm the entry.

5. Press **OK** to confirm the result.

Further samples with emptying of titration cell

If the titration cell is too full, the pH value is incorrect or the methanol content drops below 25 %, the titration cell must be emptied before any further analyses can be performed.

1. Press the Navigation key RETURN to access the manual activation menu.

2. Select **EMPTY VESSEL** and press **OK** to confirm.

The titration cell is emptied into the waste bottle via pump 2.

3. Select **DISPENSE SOLVENT** and confirm with **OK**. The solvent is dispensed into the titration cell.

4. Select **CONTINUE..** and press **OK** to confirm.

Once the pre-titration has been completed and the titration cell conditioned, the text **CONTINUE..** is shown in the display.

5. Press **OK** to confirm.

6. Dispense the sample into the titration cell.

7. Select **START TITRATION** and press **OK** to confirm.

During the titration, **WEIGHT ENTRANCE** is shown in the display.

8. Enter the weight of the sample via the keypad and press **OK** to confirm the entry.

9. Press **OK** to confirm the result.

10. Press the Navigation key RETURN to end the titration sequence, select QUIT.

4.7 Manual component activation

4.7.1 Burette

1. Select **MANUAL ACTIVATION > BURETTE** and press **OK** to confirm.
2. Select **FILL** with the **DOWN** navigation key to fill the burette.
3. Select **EMPTY** with the **UP** navigation key to empty the burette into the titration cell.
4. Select **RETURN** with the **LEFT** navigation key to empty the burette back into the titrant bottle.

Note: Repeat this procedure multiple times to make sure that the dispensing process functions correctly.

4.7.2 Pumps

1. Select **MANUAL ACTIVATION > PUMPS** and press **OK** to confirm.
2. **EMPTY VESSEL** activates pump 2 to empty the titration cell into the waste bottle.
3. **DISP SOLVENT** activates pump 1 to dispense the solvent into the titration cell.
4. Select **QUIT** with **OK** to exit the menu.

Note: Repeat this procedure multiple times to make sure that the dispensing process functions correctly.

4.7.3 Stirrer

1. Select **MANUAL ACTIVATION > STIRRER** and press **OK** to confirm.
2. Press **OK** to switch the stirrer on or off.
3. Use the navigation keys **UP** and **DOWN** to select the stirring speed.

The stirring speed can be modified during the vessel conditioning, pre-titration and titration.

Once the stirring speed has been selected it is recommended to maintain it constant during the analysis.

4.8 Programming

4.8.1 Configuration of the calibration program

The function can be used to adapt the calibration program to specific requirements.

1. Select **PROGRAMMING > KF STANDARDIZATION** and press **OK** to confirm.
2. Select **TYPE** and press **OK** to confirm.

CLASSIC is suitable for titration with standard reagents.

SPECIAL is suitable for titration with special reagents, such as aldehyde and ketone. An end point of 200 mV is recommended for this setting.

3. Select **STANDARD** and press **OK** to confirm.

STANDARD (G) is used for a standard solution with a known water concentration specified in grams (g).

STANDARD (V) is used for a standard solution with a known water concentration specified in milliliters (mL).

H2O is selected when distilled water is used as the standard.

TARTRATE is selected when sodium tartrate 2-hydrate is used as a primary standard with a water content of 15.66 %.

4. Select **STD. V.** to enter the volume of the employed standard solution in mL. Press **OK** to confirm.
5. Select **EP DELAY** to define a time in seconds during which the end point of the reaction must remain stable. Press **OK** to confirm.
6. Select **DRIFT L.** to define a maximum drift limit in $\mu\text{L}/\text{min}$. Press **OK** to confirm.
7. Select **MAX. VOL.** to define the maximum volume of the titration cell. The default setting is 10 mL. If the maximum volume is reached, the titration stops and the following error message is displayed: **MAXIMUM VOLUME REACHED**. Press **OK** to confirm.
8. Select **L. COMMENT > NO** or **YES** to enter comments. Press **OK** to confirm.

If **YES** is selected, up to eight comment lines can be entered using a standard keyboard. This text is displayed in printouts.

4.8.2 Configuration of the titration programs

The titrator features four titration programs, which can be adapted to specific requirements. The default program settings are detailed in [section 4.4](#).

1. Select **PROGRAMMING > P1. KF STANDARD** or another of the four available titration programs. Press **OK** to confirm.
2. Select **PROGRAM > ACTIVATED** or **DEACTIVATED** to show/hide the program in the titration menu. Press **OK** to confirm.
3. Select **TYPE** and press **OK** to confirm.

CLASSIC is suitable for titration with standard reagents.

SPECIAL is suitable for titration with special reagents, such as aldehyde and ketone. An end point of 200 mV is recommended for this setting.

4. Select **EXTRACTION** and press **OK** to confirm.

PREVIOUS TO TITRAT is used to program a time prior to titration at which the sample is to be dispensed into the titration cell. This setting is particularly useful for samples that release water at a slow rate.

DURING TITRATION is used to program a minimum titration period required to make sure that all of the water contained in the sample is released.

If **NO** is selected, the titration will start immediately after the sample has been added to the titration cell.

5. Select **EP DELAY** to define a time in seconds during which the end point of the reaction must remain stable. Press **OK** to confirm.
6. Select **MAX. VOL.** to define the maximum volume of the titration cell. The default setting is 10 mL. If the maximum volume is reached, the titration stops and the following error message is displayed: **MAXIMUM VOLUME REACHED**. Press **OK** to confirm.
7. Select **DRIFT C. > AUTOMATIC** or **MANUAL**. Press **OK** to confirm.

AUTOMATIC: a maximum drift limit of 30 $\mu\text{L}/\text{min}$ must not be exceeded. A sample cannot be added before the drift limit is met. The drift limit can be changed.

MANUAL: a sample can be added at any time.

If the drift control takes more than 15 minutes, the process is stopped automatically and the titrator switches to the standby cycle.

8. Select **UNIT** to define the results output. The following units are available for selection: mL, mg, ppm, %, A.U. volume and A.U. weight. Press **OK** to confirm.
9. Select **L. COMMENT > NO** or **YES** to enter comments. Press **OK** to confirm.
If **YES** is selected, up to eight comment lines can be defined using a standard keyboard. This text is displayed in printouts.

4.9 Data log

This section describes the functions of the data log.

- Up to 55 titration or calibration results are stored.
 - The results can be displayed, printed or sent to a computer.
 - When the data log is full, the oldest result is overwritten automatically.
1. Select **DISPLAY DATA > DISPLAY DATA** and press **OK** to confirm. A range of search filters can be used to display the results (X = all).
BY DATE: displays the results for a specific date.
BY SAMPLE ID: displays the results for a specific sample.
BY USER: displays the results obtained by a specific user.
BY TYPE: displays either titration or calibration results.
CONTINUE: displays all results.
 2. To empty the data log, select **DISPLAY DATA > EMPTY DATA-LOGGER** and press **OK** to confirm.

4.10 Printer/computer

This function is only displayed if a printer or computer is connected and activated for data output. Programs, settings and results can be printed or transferred. Following a titration or calibration, the following data is printed or transferred:

- Header line (2 lines of 20 characters each), date and time, reagent factor, drift, sample ID, titration result, final volume, duration of titration and operator ID.
1. Select **SYSTEM > DATA OUTPUT**.
 2. Select **FOR PRINTER** followed by the relevant printer model, such as thermal or dot matrix. Confirm with **OK**.
 3. Select **FOR COMPUTER** followed by either **CAPTURE** or **TICOM**. Confirm with **OK**.

4.11 System

This function can be used to adapt the titrator to specific requirements.

REAGENT NAME: entry of a reagent name via an external PC keyboard. The reagent name is printed (maximum of 10 characters).

OPERATOR NAME: up to four operator names can be defined via an external PC keyboard. The operator name is printed (maximum of 17 characters).

DATA OUTPUT: deactivates or activates data output on the printer or computer.

VOLUME TEST: program for burette calibration.

ENTRY OF WEIGHTS: manual entry, or automatic if scales are connected. The communication is defined via a protocol (baud rate, word length, parity, stop bits).

STANDBY CYCLE: entry of standby interval, default setting 15 min.

TIME D. SOLVENT: time in which the solvent is dispensed into the titration cell, default setting 13 s.

DATE/HOUR: entry of date and time.

DISPLAY CONTRAST: increases or decreases the display contrast.

LANGUAGE: English, Spanish, Italian, French.

4.12 Default settings

The instrument features four titration programs and one calibration program. The default settings are as follows:

Program 1

KF Standard: activated

Titration type: classic

Drift control: automatic, maximum drift: 30 $\mu\text{L}/\text{min}$

Unit: %.

Program 2

KF < 1 % H_2O , deactivated

Program 3

KF > 10 % H_2O , deactivated

Program 4

KF Standard, deactivated

Calibration program: classic

Water standard: water standard in volume (mg $\text{H}_2\text{O}/\text{mL}$)

The following overview indicates the recommended program for various sample types, quantities and reagents.

Water content %	Sample quantity g	Titer	Titration consumption mL	Program number
100	0.1	5	20	P3
10	0.1–0.2	5	2–4	P1
1	1	5	2	P1
0.1 (1000 ppm)	5–10	5	1–2	P2
0.01 (100 ppm)	10–20 10	5 2	0.2–0.4 0.5	P2
0.011 (10 ppm)	20–30	2	0.125–0.150	P2

NOTICE

Warning against system damage

Before maintenance or repair work is conducted, thoroughly rinse the instrument with methanol and make sure that there are no residual chemicals in the tubes and pumps.

Only use genuine replacement parts and accessories.

The instrument must be serviced by the manufacturer's service department at the prescribed intervals.

5.1 Maintenance schedule

Maintenance task	every week or more	6 months	12 months
Replace syringe.			x
Replace valve block.			x
Check burette feed tube, replace if damaged.			x
Check burette discharge tube, replace if damaged.			x
Peristaltic pump, pump cassette.		x ¹	x
Check pump feed tube, replace if damaged.			x
Check pump discharge tube, replace if damaged.			x
Check bottle closure set, replace if damaged.			x
Replace dry desiccant cartridges every week or more frequently upon ambient humidity.	x		
Check all tube connections for leaks and damage.	x		
KF titration cell Viton O-ring.			x

¹ When using Chloroform in solvent, it is recommended to replace the pump cassette every 6 months.

5.2 Power off the instrument

NOTICE

Never clean the tubes, pumps and burette with distilled water.

At the end of the working day, deactivate the instrument as follows:

- Empty the contents of the burette into the titrant bottle; refer to [section 4.7.1, page 33](#).
- Empty the titration cell; refer to [section 4.7.2, page 33](#).

When the instrument is to be deactivated for multiple days or extended periods, perform the following steps:

- Clean the burette and pump with methanol; refer to [section 4.7, page 33](#).
- Seal the reagent bottles with the original bottle closures.
- Empty and clean the titration cell.
- Store the desiccant cartridges, in an exsiccator for example.
- To avoid sediment intake, make sure that the feed tubes do not touch the bottom of the bottles.

5.3 Clean the burette

Make sure that there are no crystals or other sediments inside the syringe. If such deposits are discovered, clean the syringe immediately, as this will otherwise damage the plunger.

The temperature of the liquid inside the syringe must be between 15 and 40 °C.

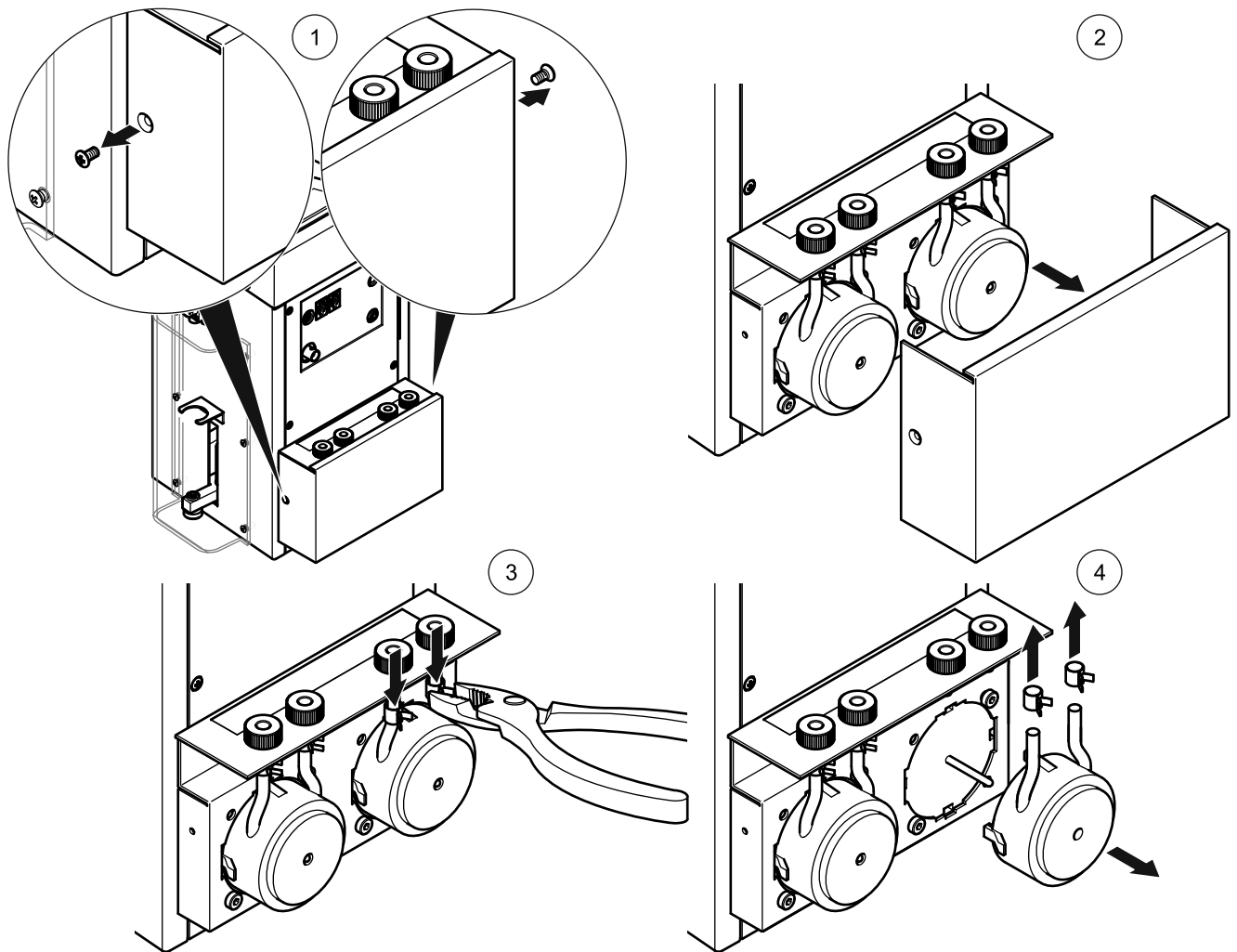
5.4 Clean the electrode

The double-platinum electrode does not require any special maintenance. Simply rinse with ethanol if required.

Remove any sticky materials with solvent and soft tissue. Pay attention not to twist or bend the platinum wires.

5.5 Replace pump tubes

1. Remove the screws on the right and left of the housing cover (refer to point 1 in [Figure 14](#)).
2. Remove the housing cover.
3. Press the ends of the gripper clamps together (with pliers, for example) and slide the clamps down and off the connectors.
Remove the tubes from the connectors.
4. Press in the catches on the right and left of the pump cassette.
Remove the pump cassette from the shaft.
5. Slide the gripper clamps onto the tubes of a new pump cassette.
6. Slide the new pump cassette onto the shaft until the catches engage.
7. Slide the tubes onto the connectors.
8. Press the ends of the gripper clamps together (with pliers, for example) and slide the clamps up onto the connectors.
9. Put the housing cover back on and tighten the screws.

Figure 14 **Replace pump cassette**

1 Remove the screws on the right and left of the housing cover.	3 Press the ends of the gripper clamps together (with pliers, for example) and slide the clamps down and off the connectors. Remove the tubes from the connectors.
2 Remove the housing cover.	4 Press in the catches on the right and left of the pump cassette. Remove the pump cassette from the shaft.

Section 6 Troubleshooting

6.1 Error messages

Error displayed	Cause	Resolution
Factor value higher than 10 mg H ₂ O/mL	The factor of the reagents varies between 1 and 5 mg/mL. Excessively high values indicate an anomaly of the sample or an error in the standard weight input.	Check the sample for side reactions. Check the weight input.
High drift	Drift higher than 30 µL/min. Tubes and burette are moist. Sample displays interfering side reactions. Sample only releases water slowly. Titration cell is not closed correctly.	Upon start-up: rinse all tubes using KF reagent. Following titration of a sample: use a special KF reagent that does not cause any interfering side reactions with the sample.
Drift too high	Drift higher than 60 µL/min. Tubes and burette are moist. Sample displays interfering side reactions. Sample only releases water slowly. Titration cell is not closed correctly.	Increase the interval between dispensing of the sample and the start of titration. Check that the titration cell is correctly positioned; grease the filler inlets for the sample addition.
Conditioning not possible	If the message "Drift too high" is displayed for more than five minutes, the process is cancelled.	Check the O-ring of the titration cell. Check the desiccant cartridges.
Maximum volume reached	The maximum volume is reached before the titration is completed. The titration is cancelled automatically.	Empty the titration cell and restart the titration.
- - - Value not calculable	The result is outside the accepted limits.	Repeat the titration.
Data logger empty	No results are stored or no results match the search filter.	Change the search filter function.
All data will be erased	All data in the data log will be erased.	
Printing error	Printer is connected but not activated.	Switch on the printer.
PC not connected	Computer is activated but not connected.	Check the computer connection.

6.2 Incorrect results

Incorrect results	Cause	Resolution
The result differs from the expected value.	The sample reacts with the titration medium.	Check whether the sample contains interfering ions that react with the reagents. Use a different reagent.
	Sample only releases water slowly.	Increase the interval between dispensing of the sample and the start of titration.
	The reagent factor is incorrect or has not yet been calibrated.	Perform a calibration.
	Sample has very low water content.	In the case of samples with a very low water content, reproducibility greatly depends on prior handling, preparation and addition of the sample. Increase the sample quantity.
	Water capacity of solvent exhausted.	Empty the titration cell and add new solvent.
Poor reproducibility of results	Very small size of control sample	Increase the control sample size
	Sample not homogeneous	Homogenize the sample and increase the control sample size
	Sample has very low water content.	In the case of samples with a very low water content, reproducibility greatly depends on prior handling, preparation and addition of the sample. Increase the sample quantity.
Very slow titration	Sample only releases water slowly.	Increase the interval between dispensing of the sample and the start of titration.
Factor not reproducible or too high	The employed standard is water.	The use of water as a standard requires extensive practical experience; use a standard solution.
	The employed standard is sodium tartrate 2-hydrate.	The reagent does not immediately dissolve in the solvent. Increase the interval between dispensing of the sample and the start of titration.
	The employed standard is a normal standard solution.	Make sure that the correct standard concentration has been entered.
Solution in titration cell turns brown	Over-titration	The electrode is contaminated and must be cleaned or the electrode is broken/cracked at platinum wire level and need to be replaced.

Section 7 Replacement parts and accessories

7.1 Replacement parts

Description	Cat. No
TitraLab KF 1S 2B, Karl Fischer Titrator, with 1× 5 mL syringe and 2 pumps. Included accessories: electrode holder with magnetic stirrer, electrode 52 64, cable for electrode and special KF titration cell	LLV8671.97.1202
Double-platinum electrode (Pt), 0–80 °C. For KF and SO ₂ titrations	LZW5264.97.0002
Titration stand, with magnetic stirrer and titration cell for KF.	LZW9160.99
Teflon coated stirring bar, 20 × 6 mm, 10 units	LZW9339.99
KF Glass vessel, 120 mL, for TitraLab KF	LZW9142.99
O-ring for titration cell, Viton	LZW2-145V.99
Borosilicate glass syringe for burette, TLL SL, 5 mL	LZW9228.99
Hardware sleeve for 5 mL syringe	LZW8741.99
White O-rings (× 10)	LZW8734.99
Inlet tube set for burette, L= 65 cm (2.13 ft) , d=1.5 × 2.5 mm (0.06 × 0.1 in), black sheath	LZW8701.99
Outlet tube set, L= 46 cm (1.51 ft), d= 2 × 1 mm (2 × 0.04 in), black sheath, antidiﬀuser, conical adapter	LZW8708.99
Tube for emptying/dispensing pump, L= 65 cm (2.13 ft) , d=1.5 × 2.5 mm (0.06 × 0.1 in), conical adapter	LZW8710.99
Pump cassette with neoprene tube, internal diameter 3.2 mm, flow rate 170 mL/min.	LZW9082.99
Desiccant cartridge	LZW9200.99
Screw cap DIN 45	LZW8729.99
KF Glass vessel, 120 mL, Thermostated, for TitraLab KF	LZW9139.99
Electro-valve for Burette	LZW9249.99
AS7 cable / 1M / BNC. For instruments with BNC connector	LZW9055.99

7.2 Accessories

Description	Cat. No
Standard PC keyboard, mini-DIN connector.	LZW9013.99
RS 232 C cable for connection between titrator and PC, with 9-pin and USB connectors	LZW9135USB.99
Cable for connection between scales and titrator. Cable made on demand depending balance model, please contact your local distributor.	LZW87XX.99

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HACH LANGE OOO

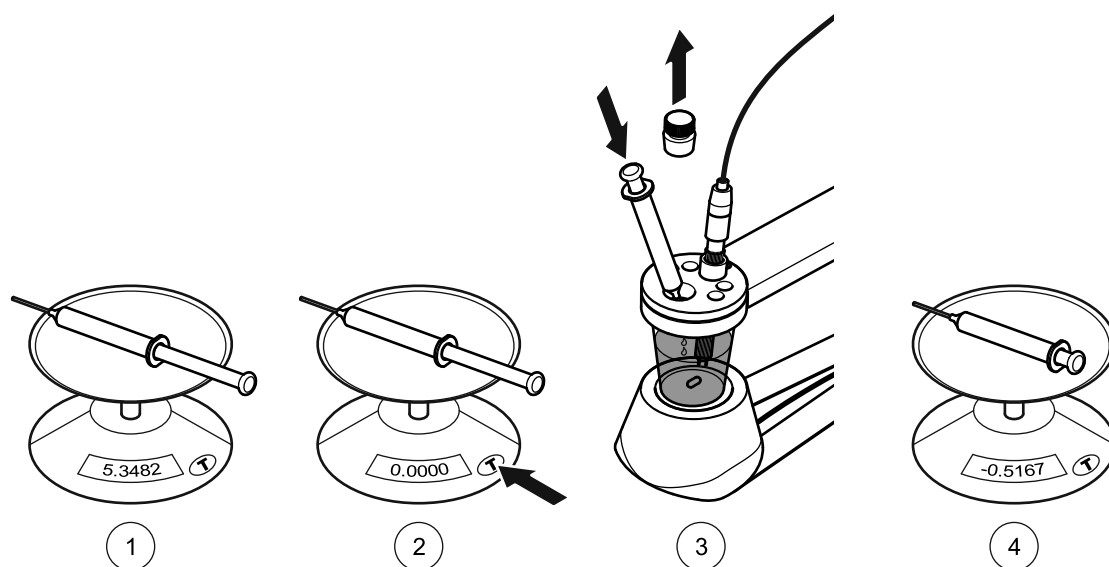
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Appendix A Weigh the sample

Precise sample and standard weights are absolutely essential for the calculation of correct results.

1. Weigh liquid or viscous samples with a syringe and solid samples with a weighing boat.
2. Place the filled syringe or weighing boat onto the analytical balance and set the balance to zero via the tare function.
3. Dispense the sample into the titration cell.
4. Place the empty syringe or weighing boat back onto the balance to obtain the weight difference of the sample as a negative number.
5. Enter this figure into the titrator as the sample weight.

Figure 15 **Weigh the sample**



Appendix B Volume test

The volume test calibrates and checks the burette.

Different volumes are dispensed from the burette into a vessel on high-precision analytical balance. Based on the weights measured by the balance, the instrument automatically calculates the volume dispensed by the burette. The difference between the actual volume and nominal volume of the syringe is used to determine a correction factor to be used in the subsequent calculation.

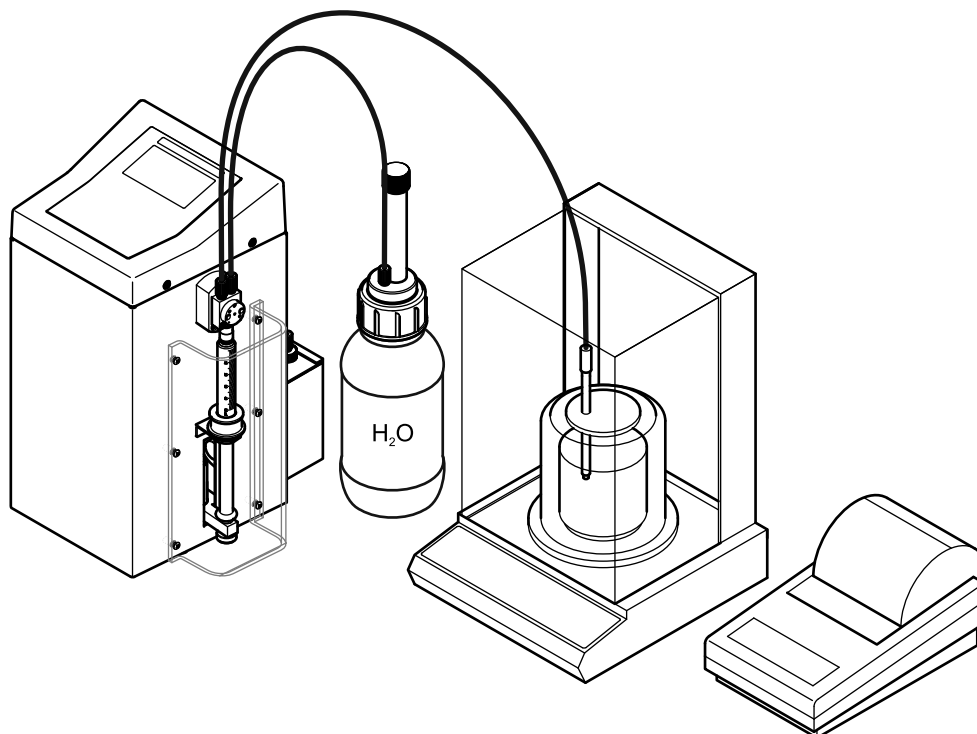
If the instrument is connected to a printer, a report detailing the established data is provided. The procedure and maximum acceptable error are based on standard UNE-EN ISO 8655.

- The test is performed with doses equivalent to 10, 20, 30, 50, 70, 80, 90 and 100 % of the entire syringe volume.
- The syringe is fully filled before each dose.
- The titrator calculates a correction factor after each dose.

8.1 Required equipment

- Analytical balance, resolution 0,0001 g, with RS 232 C output.
- Thermometer with resolution of 0,1 °C.
- Protective cover for analytical balance (Cat. No LZW8721.99).
- Cable for connection between titrator and balance.
- Liquid to be dispensed: distilled water, at room temperature.
- Vessel on balance, to hold the liquid during the tests.
- Printer (for example, CITIZEN CBM-270) connected to the titrator.

Figure 16 **Volume test**



8.2 Execution

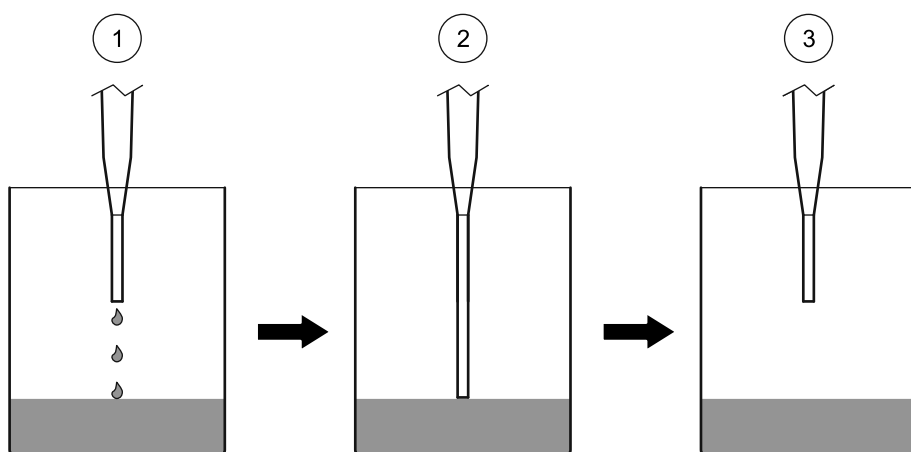
1. Position the titrator next to the balance.
2. Clean the burette to remove any previously used reagents.
3. Make sure that the syringe and tubes are in perfect condition.
4. Fill the syringe with distilled water.
5. Fill a vessel with a little distilled water and place it onto the balance.
6. Place the protective cover over the balance. The burette discharge tube must extend into the vessel via a cannula.
7. Select **SYSTEM > VOLUME TEST** and follow the instructions on the titrator.
Enter the temperature and air pressure.

Note: It is essential that all the dispensed water is transferred to the vessel on the balance. Therefore, the tip of the cannula must be lowered to the liquid surface after each dose. The cannula is then withdrawn and the weight is read from the balance.

8. If the displayed results, correction factors and standard deviations are within the permitted limits, the titrator will function correctly.

Note: Clean the burette with ethanol after the volume test.

Figure 17 Immerse the cannula



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